Creationist Conceptions in 14 Countries. How to Teach Evolution to French Students Coming from Immigration?

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Creationist Conceptions in 14 Countries. How to Teach Evolution to French Students Coming from Immigration?

Running head: How to Change Creationist Conceptions?

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Abstract:
Even in France, where creationist ideas are not widespread, more and more teachers are confronted to some difficulties when teaching the biological evolution, mainly with students coming from families immigrated from North Africa or Sub-Saharan Africa.
In a first part, to better realize the conflict between the French culture and their African initial culture, we will present some results analyzing the creationist ideas of teachers in 14 countries (n = 5706), including France and 5 African countries (Morocco, Algeria, Tunisia, Senegal and Burkina Faso).
We will then analyze the creationist conceptions of 17-18 year old students in a high school of the suburb of Lyon (France) and the main epistemological and socio-cultural obstacles to learning evolution. We will finally present the new strategies of two teachers (biology and philosophy) to help their students to accept the idea that biological evolution is not in contradiction with their possible belief in God, science and religion being two distinct areas.

Keywords: Science - Religion - Creationism - Students - Teachers - Biology - Philosophy -

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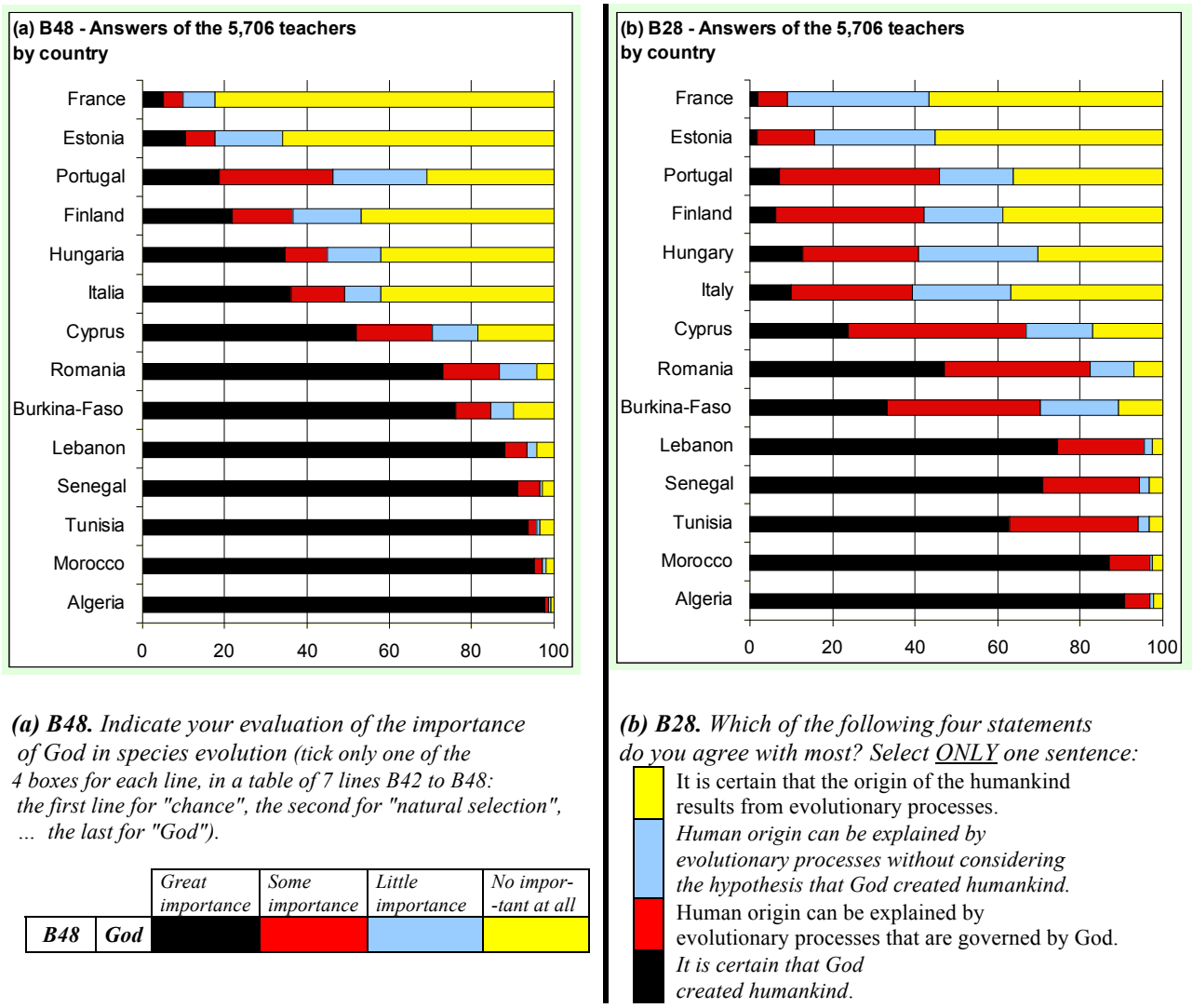
Schools are the core targets of the anti-evolutionist offensive (1, 2, 3, 4). Even in France, where the creationist ideas are a little minority (5, 6, 7, 8), more and more teachers are confronted to some difficulties when teaching the biological evolution. The present paper is showing that these difficulties are mainly a consequence of differences between the French secular culture and the familial cultures of the descendants of immigrants.

1 - A comparative study across 14 countries: conceptions on Evolution as an indicator of the conflict of cultures between France and African countries historically linked to France.

A wide-ranging research project, BIOHEAD-Citizen, *"Biology, Health and Environmental Education for better Citizenship"* (9) studied the creationist conceptions of 7050 teachers in 19 countries in Europe, Africa and the Middle East and identified for the first time their importance in the context of these teachers' religious, economic, cultural and political backgrounds (7, 8). The sample was a balanced set of in-service teachers (i.e. currently active, certified teachers) and pre-service teachers (i.e. students in their last year of teacher training), in both primary and secondary schools, who taught biology or the national language.

SAMPLES (14 countries, total = 5,706 teachers)

	Country	Total	including biologists	% Atheist. Agnostic	% Catholic	% Protestant	% Orthodox	% Muslim	% Other
BF	Burkina Faso	296	110	2,4	**45,6**	18,6	0,0	24,7	8,8
CY	Cyprus	322	66	4,0	9,0	1,2	**77,3**	0,0	8,4
DZ	Algeria	223	88	1,3	0,0	0,0	0,0	**91,9**	6,7
EE	Estonia	182	108	**43,4**	7,7	14,8	2,2	0,5	**31,3**
FI	Finland	306	121	15,0	1,0	**66,3**	2,9	0,0	14,7
FR	France	732	319	**50,5**	**38,1**	1,9	0,3	1,5	7,7
HU	Hungary	334	112	15,3	**46,4**	16,2	0,0	0,0	22,2
IT	Italy	559	150	12,3	**78,7**	0,5	0,0	0,0	8,4
LB	Lebanon	722	261	0,4	21,1	0,4	8,3	**65,0**	4,8
MA	Morocco	330	186	0,6	0,0	0,0	0,0	**97,3**	2,1
PT	Portugal	350	111	9,4	**76,3**	7,4	0,0	0,0	6,9
RO	Romania	273	127	7,3	8,1	7,0	**71,1**	0,0	6,6
SN	Senegal	324	120	0,9	8,3	0,0	0,0	**89,2**	1,5
TN	Tunisia	753	326	1,9	0,0	0,0	0,0	**96,0**	2,1



(a) B48. *Indicate your evaluation of the importance of God in species evolution (tick only one of the 4 boxes for each line, in a table of 7 lines B42 to B48: the first line for "chance", the second for "natural selection", ... the last for "God").*

		Great importance	*Some importance*	*Little importance*	*No impor--tant at all*
B48	***God***				

(b) B28. *Which of the following four statements do you agree with most? Select ONLY one sentence:*

- It is certain that the origin of the humankind results from evolutionary processes.
- *Human origin can be explained by evolutionary processes without considering the hypothesis that God created humankind.*
- Human origin can be explained by evolutionary processes that are governed by God.
- *It is certain that God created humankind.*

Figure 1 - Teachers' answers to questions B48 and B28 (in 14 countries)

The results show a strong correlation between creationist conceptions, belief in God, religion practice and also with the GDP (Gross Domestic Product) per person of each country. The percentage of radical creationist conceptions is very different from one country to an other (from

2% in France to 92% in Algeria), but does not differ, or just a little, from one religion to an other inside each country.

This research used a questionnaire which included questions related to Evolution as well as questions regarding personal information (such as age, gender, political and religious beliefs).

Figure 1 illustrates the results from two questions filled out by 5,706 teachers in 14 countries. They show that French teachers are the most evolutionist inside this sample while non-European teachers, in countries historically linked to France, are the most creationist.

Answering to the question B48 (figure 1a), related to *"the importance of God in species evolution"*, the creationist teachers ticking *"great importance"* or *"some importance"* were 8% in France but around 95% or more in Lebanon, Senegal, Tunisia, Morocco and Algeria.

Answering to the question B28 (figure 1b), 2% of teachers ticked the radical creationist item ("*It is certain that God created humankind"*) in France, while 62 to 92% in Tunisia, Lebanon, Senegal, Morocco and Algeria. Nevertheless, other teachers were both creationist and evolutionist, ticking the third item ("*Human origin can be explained by evolutionary processes that are governed by God").* : 6% of teachers in France, from 6 to 32% in Algeria, Morocco, Senegal, Lebanon and Tunisia.

In the suburb of big French towns, part of the population come from African countries historically linked to France as Algeria, Morocco, Tunisia or Senegal. Even when they have been French for one or more generations, these families keep contacts with their country of origin. Because of these cultural roots, and because of possible socio-economical difficulties in France, they often defend a socio-religious identity including creationist positions.

2 - Conceptions on Evolution of 17-18 years old French students who are the descendants of immigrants.

Our inquiry deals with the 58 students of two science classes, last year of a High School (called "Doisneau"). Their mean age is 17-18 years old, 22 are girls and 36 boys. Most of them are coming from migrant families. They mainly come from North Africa but some of them also come from Sub-Saharan or Asian countries. In November 2008, these 58 students anonymously filled out a questionnaire including the same questions related to Evolution as in the questionnaire used for the BIOHEAD-Citizen research. Figure 2 shows that their conceptions are precisely at a middle way between those observed in Algeria or Morocco (> 82% of radical creationist conceptions) and in France (2% of radical creationist conceptions): 38% quoted the radical creationist item in the question A64 related to the origin of life; 31% quoted a clearly evolutionist conception, and 31% a creationist and evolutionist conception.

In this High School, out of 58 students, 31 said they were Muslim (Sunni), 10 Catholic, 1 Protestant, 2 "Deist", 9 Agnostic or Atheist and 5 did not wish to answer this question. As shown in figure 3, 41 of them claimed to believe in God (72%, question P12a), 38 of them quoted *"great importance"* and 3 of them *"some importance"* of God in species evolution (72%, question B48). Nevertheless, only about half of these 41 students quoted a radical creationist conception: 22 for the origin of life (question A64) and 21 for the origin of humankind (question B28): figure 3. The other half is at the same time evolutionist and creationist (item 3 of the questions A64 and B28) or even sometimes clearly evolutionist.

From previous questionnaires filled out during the previous years, we were expecting more radical creationist conceptions related to the origin of humankind, the most frequent comments written by students being: *"the man cannot come from monkey"*. In fact, their amount is globally the same as for the origin of life (figure 3). Nevertheless, this amount is still too high in respect to the goal of teaching biological evolution in school, and we need to better understand why and then to improve this teaching.

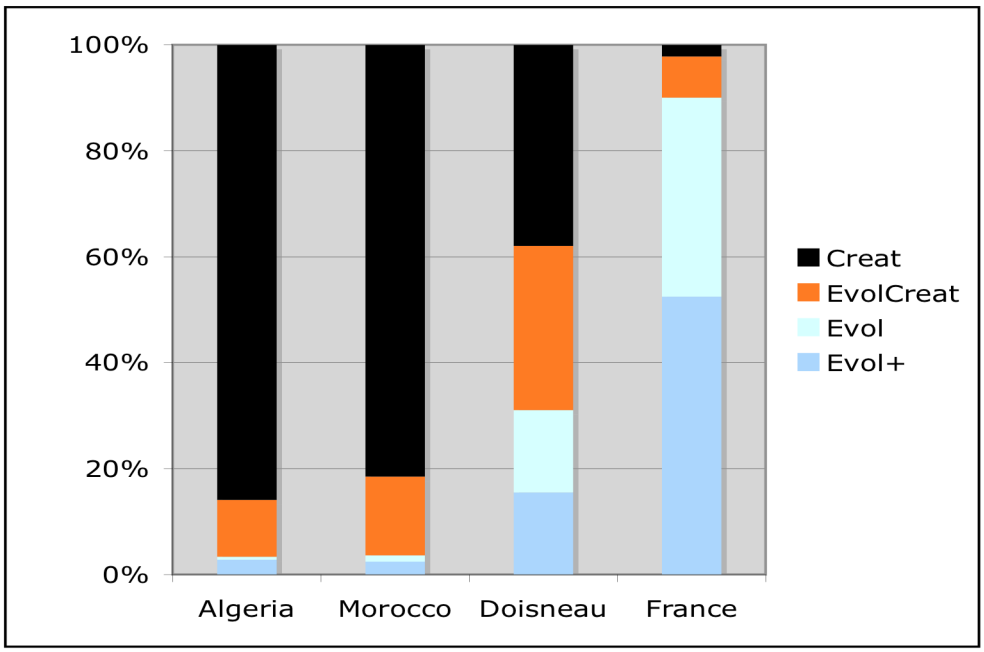


Figure 2 - Answers of teachers and students from 3 countries (see samples in figure 1) and of the students last year of the High School Doisneau (sections Science, n = 58) to the question A64 - *Which of the following four statements do you agree with the most? (tick only ONE answer)*

It is certain that the origin of life resulted from natural phenomena

The origin of life may be explained by natural phenomena without considering the hypothesis that God created life

The origin of life may be explained by natural phenomena that are governed by God

It is certain that God created life

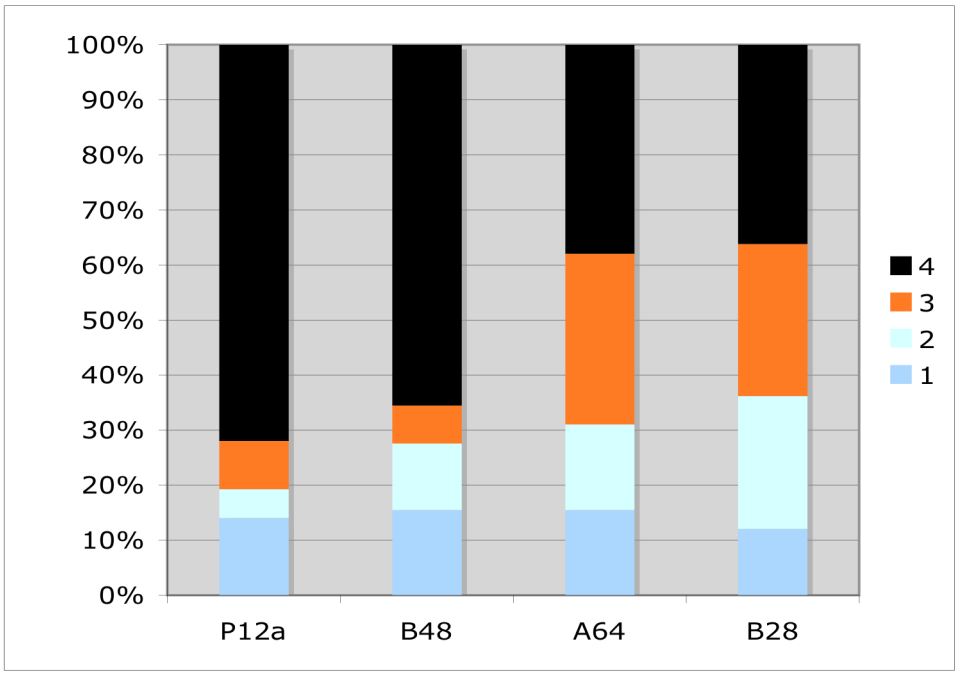


Figure 3 - Answers of the 58 students (High School Doisneau) to 4 questions: B28 and B48 presented in the figure 1: B48 = importance of God in the evolution of species (from black for "very important" to blue for "not important at all"); B28 = origin of humankind (the same 4 categories as in figures 1 and 2), A64 (origin of life: figure 2) and P12a: "I believe in God" (from black for "yes" to blue for "no")

3 - Identification of obstacles to teaching / learning Evolution

These obstacles have been identified during the last 4 years when trying to teach Evolution in this High School.

3-1. A socio-cultural obstacle. It is probably the main point. Some students are blocked when Evolution is taught because they are a priori convinced that it is "against their faith", against their socio-cultural and religious identity.

The solution can be to actively work with students to define the way they relate to scientific knowledge, and also to religion. To help them to understand what a science is (not a dogma), what is a proof, a scientific design, what are the domains of science (the same object can be described differently in reference to different scientific approaches) and what the other domains of truth outside science (aesthetic, religion, moral, …) are. Gould (10) did a distinction between Science and Religion, two NOMA (Non-Overlapping MAgisteria). We prefer to speak about Science and Morals (including religion, but also rules of not believers) and to define these two domains by their respective KVP (knowledge, values and practices): figure 4.

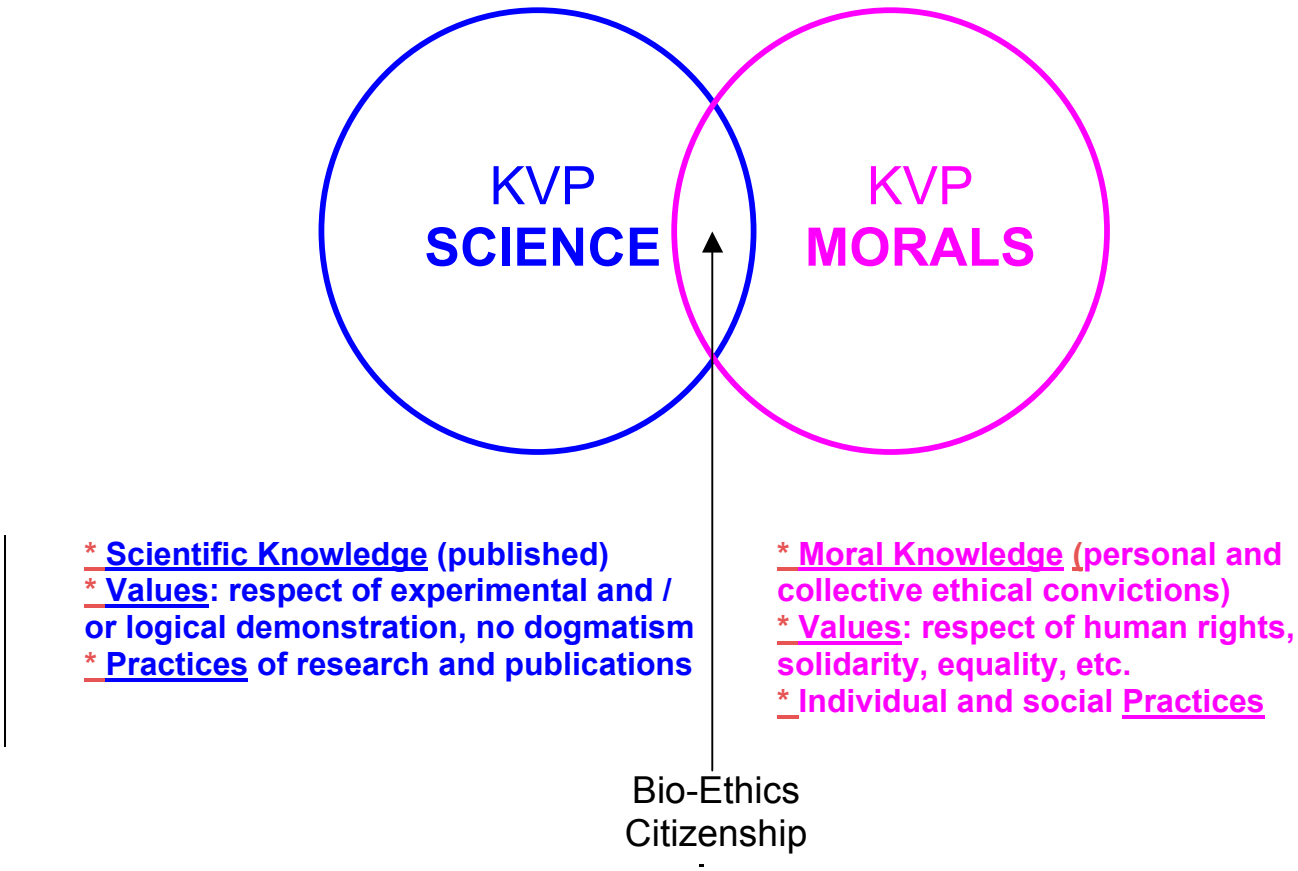


Figure 4 - The domains of Science and Morals (KVP = Knowledge, Values, Practices). They are partly overlapping. Gould (2000) defined two NOMA (Non-Overlapping MAgisteria): Science and Religion.

3-2. Several epistemological obstacles. When students are ready to learn, there are several difficulties to teach Evolution. We just list them here:

* Different scales of time: *« My grand-father was not a monkey ! ». Students often make confusion between* lifetime, time of familial memory, time of history, time before history, geological times … There are strategies and metaphors to introduce these important concepts.

* Continuity and rupture between animals and humankind. Students have difficulty understanding that the biological continuity does not mean a reduction of a human being to any animal. The human brain is the biological support of human thought (including social and moral thought) that is specifically human (philosophy insists on this point). Nevertheless, other animals can develop some social relationships, some language, etc. These points are a specific target of a useful interdisciplinary teaching, joining biology and philosophy.

* By chance or by intention? Creationists trap us in a false alternative: only by "blind chance" or by a "Creator"? Nevertheless, evolutionists never say « blind chance » alone ! Chance is always combined with NATURAL SELECTION to build emergences and adaptations. To teach better the concept of « chance » is today an essential challenge of biology education. As Dobzhansky wrote (11): « Natural selection does not work according to a fore-ordained plan, and species are produced not because they are needed for some purpose but simply because there is an environmental opportunity and genetic wherewithal to make them possible. »

4 - New attempts to improve teaching of the biological evolution.

4-1. In Doisneau High School, where two of us are teaching, Biology or Philosophy, the first step was to take into account the previous conceptions of students, and to talk with them about the possible compatibility between their eventual religious faith and the scientific facts of biological evolution. If not, many students learned the biological evolution and passed their tests during the year (and in the final exam) but, when discussing with the teacher of philosophy, they clearly said that they did not believe what they learned. For them, in accordance with their familial, socio-cultural and religious context, there is a contradiction between their faith and the taught biological evolution. As a consequence, the teachers of Biology and Philosophy decided to join sometimes their classes to teach this topic in an interdisciplinary perspective, and to organize debates on Evolution in the High School, with precise targets, dealing mainly with epistemology and history of science: What is a science? What is a scientific method? What is a religion? Do they overlap (figure 4)?

With the Darwin year 2009, some help was found to organize conferences, workshops and debates. A new test will be made at the end of this school year. The previous evaluations, comparing answers to a questionnaire before and after sequences of biology on the topic of evolution showed little evolution in the students' opinions, confirming a well known result from research in biology education (12): opinions, values, are more difficult to change than the students' scientific knowledge.

Nevertheless, some students really changed. We did an interview of one of them, engaged in studies of biology in the University and still strongly believing in God: she is really at the same time evolutionist and creationist, exactly as Dobzhansky wrote in his famous paper (11): *"I am a creationist and an evolutionist. Evolution is God's, or Nature's, method of Creation"*. This student told us that she came back to explain to her imam that the Evolution taught in the University is very different from what he said about this topic, and that there is in fact no contradiction between the biological knowledge and the faith in God. In the United States, the National Academy of Sciences (13) also stressed that *"many religions and denominations accept the scientific evidence of evolution"*. Several fundamentalist believers, as well as some dogmatic atheist scientists, are not yet convinced of that…

4-2. The interdisciplinarity between biology and philosophy appears as an urgency to teach better the biological evolution. We participated in a recent Meeting in Paris (13-14 Nov. 2008) with hundreds of French teachers and inspectors of biology and philosophy and some researchers, on the topic "Teaching Evolution". The debates were sometimes difficult, but this interdisciplinary perspective appeared necessary to introduce epistemological and historical dimensions when teaching evolution and differentiating its scientific content from any ideology or religion.

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